

knowledge, each enjoying an indefinite, though possibly a correlated scope in its own domain. The indestructibility of both matter and force implies a fixed coefficient of force for matter in equilibrium; but how great is the contrast offered in this respect by such energies as life and will!

Now, if this reasoning be correct, we may have in this class of energies that middle term, so earnestly desired and so intensely needful, which unites the phenomena of matter with those of spirit, and forms the connecting link between science and religion, their harmonious conjunction affording the highest system of philosophy. It is this class of energies which, controlling the forces of matter, guides and governs their modifications and transformations. It is this, moreover, which, inseparable from mind, is exerted by all conscious organism. The mystic play of coequal, but, to our senses, so dissimilar forces, and the equally recondite mutual action of the eye, the brain, and the nerve, alike demand agencies transcending all our science, yet implicitly obeying physical laws. The highest manifestation of these agencies is in will; the highest agent is the Almighty. Thus the dictum of faith, that the universe exists only by virtue of the continued will of its Creator, represents a palpable scientific fact; and we may see that the pantheist, the materialist, and the spiritualist (I will not be debarred from this noble word by the associations of its misuse to-day) have been contemplating the same exalted truth from different aspects, with limited ranges of vision.—*Silliman's American Journal*, March 1870.

*On the Constitution and Mode of Formation of the Ovum of the
Sacculinæ. By M. BALBIANI.*

In a note inserted in the 'Comptes Rendus' of the 29th November last, M. E. van Beneden undertook to show that the interpretation given by M. Gerbe to the facts observed by him in his investigation of the mode of formation of the ovum of the *Sacculina* is incorrect. At the same time he presents a very different explanation of these facts, and he concludes by rejecting as unfounded the inductions which M. Gerbe had drawn from his observations with regard to the constitution of the ovum in a great number of animals. In his memoir M. E. van Beneden also criticizes the opinions that I have put forward as to the nature and physiological function of the peculiar body first seen in the ova of certain spiders by some German observers, and which I subsequently made the subject of a special memoir, presented to the Academy in 1864. I shall endeavour to reply hereafter to those of M. E. van Beneden's assertions which concern me; but in the meantime it is not without interest to inquire which, M. Gerbe or M. van Beneden, is in the right in the explanation proposed by him of the facts observed by him in the *Sacculina*.

Let us first recall in a few words the manner in which these facts were detailed by M. Gerbe. According to this observer the ovum of

the *Sacculina* is constructed upon a type analogous to that of Birds; that is to say, it is composed of a nutritive part, or yelk, and a plastic part, or cicatricula. According to him, this structure is manifest especially in the young ovules, which even appear as if composed of two distinct halves or lobes separated by a median constriction, of which one represents the primitive yelk, the other the germinative portion. Afterwards the latter is no longer visible, except in the form of a small rounded prominence on the surface of the mature ovum. The yelk and the cicatricula each bear at the centre of formation a separate vesicle, such as I had myself previously assumed for the ova of a considerable number of animals; but, reversing the parts ascribed by me to each of these two constituent elements of the ovule, M. Gerbe regards the vesicle placed at the centre of the cicatricula as corresponding to the germinal vesicle of other species of animals, and that situated in the midst of the yelk as the homologue of the second vesicle which I have indicated in the vitelline nucleus of the Arachnida, Myriopoda, &c.

When M. Gerbe published these results I thought it necessary to raise some objections to his views; but not having then any personal knowledge of the facts upon which he based them, I confined myself to showing that his observations had not the precision necessary to justify the general conclusions which M. Gerbe drew from them with regard to the function of the two primitive vesicles of the ovum. I have since acquired more decisive proofs, having had the opportunity, during a recent residence on the coast, of undertaking some researches on my own account into the mode of formation of the ovum in the *Sacculina*. I have observed all the interesting facts to which M. Gerbe first called the attention of naturalists; but, like M. van Beneden, I am obliged to interpret them quite differently from the able naturalist of the College of France. On the contrary, my observations agree in almost all points with those of M. van Beneden, although made quite independently. This will appear clearly from the following *résumé* of my investigation of *Peltoaster Paguri* (Rathke).

Let us first examine the facts observed in the little Naupliiform larvæ which represent the first age of the animal at its escape from the egg. When observed in an uninjured state, we only see in their interior a mixture of refractive globules, the remains of the nutritive vitellus, and of larger bodies, refracting light much more feebly, and having all the characters of true cells. But on bursting the outer integument of the larva by careful pressure, the contents escape, and we see that these cells are rudimentary ova attached by a prolongation, in the form of a peduncle, to a slender central cord, a sort of rachis, on the surface of which the ovules originate by budding. This structure of the ovary of the larva of *Peltoaster* greatly reminds one of that of the same organ in the Arachnida. The ovules are pyriform; the largest have an average diameter of 0.025 millim.; whilst the smallest appear as almost imperceptible grains attached to the surface of the rachis. Nothing in the constitution of these bodies recalls the organization which M. Gerbe

ascribes to them in the adult *Sacculina*. The ovules, in the larva, at least during the first period which follows the exclusion of the latter, evidently only represent simple cells with their ordinary constituent parts—namely, a protoplasm which is sometimes homogeneous, sometimes more or less granular, according to the state of development, and a nucleus or germinal vesicle, 0.014 millim. in breadth in the most advanced ovules, and furnished with a single nucleolus or germinal spot, which is comparatively large and well marked. Moreover by means of reagents we may display an enveloping membrane surrounding the ovules; but this appears to me to be rather a capsular envelope than a real vitelline membrane. What are the modifications undergone by the reproductive apparatus during the successive phases through which the larva passes before commencing its sedentary and parasitic existence? My investigations have taught me nothing about this; for I have not been able to meet with the larva again until, fixed upon the abdomen of the *Pagurus*, it had become transformed into the adult animal, a sort of pouch filled with eggs, in which the latter pass through all the stages of their ovarian and embryonal evolution. At this period of their life the ovarian rachis of the larva has become transformed into a ramose organ, the numerous divisions of which serve to support a multitude of ovigerous follicles, which are appended to it as the grapes of a bunch are to its ramifications. When the ovary is torn under water, the elements enclosed in the ovigerous follicles are set free. These are, in the first place, some spherical bodies rendered opaque by the numerous refractive globules contained in their interior; these are easily recognized as ova more or less approaching their period of maturation. Their diameter varies between 0.13 and 0.15 millim. We shall revert hereafter to the constitution of these bodies. Side by side with them we see a great number of other smaller elements, as to the signification of which we may at first hesitate. Some of them are regularly round cells, 0.02–0.03 millim. in breadth, formed of a transparent, finely granular protoplasm, with a nucleus 0.015 millim. in diameter, furnished with a simple, large and rounded, very refractive nucleolus. The others have a bilobed form, and appear, at the first glance, to be constituted by the adhesion of two of the preceding cells; but a more careful examination soon shows that they are merely a state of division of the latter.

Thus we see all the forms intermediate between the simple cells and the bilobed bodies, namely:—cells still regularly spherical, but already enclosing two juxtaposed nuclei; others which begin to exhibit a median constriction of their body, with a tendency on the part of the two nuclei to separate from each other; others, finally, in which the two new cells are already well defined, but remain adherent by a larger or smaller part of their surface.

In these last elements we readily recognize the *bilobed ovules* of M. Gerbe, or the *mother cells* in their different states of division described by M. van Beneden. I have but little to add to the description given of them by this latter observer. The two daughter

cells are not at first separated by any intermediate membrane, and their protoplasm is directly continuous; so that, looking at things only by their first appearance, M. Gerbe might really be justified in thinking that he had under his eyes a small ovum with two lobes, each containing a vesicular nucleus in a common vitelline mass. But the illusion is no longer possible when these bodies have passed to a more advanced stage. In fact a transverse membranous septum is soon formed between the two adherent daughter cells, and separates their contents. This septum is visibly continuous with the line of the outer contour of the two cells, and consequently cannot be interpreted otherwise than as an internal prolongation of the enveloping membrane, which was originally common to them. Thus I cannot share in the opinion of M. van Beneden, who denies a cell-membrane to the young ovules. It is by means of this median septum, which, instead of splitting, and thus permitting the separation of the two ovules, remains simple, that the latter are, so to speak, soldered together. This splitting only takes place much later, when one of the two united cells, having alone continued its development, becomes transformed into a mature ovum, as described by M. van Beneden. We still see, for a longer or shorter time, at the surface of this ovum, the ovule which has remained stationary in its development in the form of a small rounded prominence; but this is detached when the ovum quits its follicle to pass into the oviferous pouch. It was by following the gradual development of this ovum that M. van Beneden ascertained that the supposed cicatricula with which M. Gerbe had endowed it was nothing but the little sister cell adhering to it, and that the cellular nucleus which the same observer supposed to exist at the centre of this cicatricula was only the nucleus of this same cell. We arrive at a similar demonstration by the mechanical means which enable us to separate these two bodies. Thus by rolling the ovum carefully under a thin glass cover, we sometimes succeed in detaching from it the little ovule, which, as soon as it is free, resumes its original spheroidal form. The same result is also sometimes obtained by the action of chemical substances, which cause the contraction of the protoplasm, by the tendency of the little ovule to acquire a rounded form under the influence of those reagents.—*Comptes Rendus*, December 20, 1869, tome lxi. pp. 1320–1324.

On some Mammalia from Eastern Thibet.

By M. A. MILNE-EDWARDS.

Two monkeys inhabit the coldest and least accessible forests of eastern Thibet. One is a *Macacus*, allied to *M. speciosus* and *M. tcheliensis*, in which the tail is very short. Its coat is of a dark greyish brown; the hairs, which are very long and thick, present no differently coloured bands; the lower parts of the body are of a much lighter grey, and the face and hands are flesh-coloured. The species is named *M. thibetanus*.

The second species is a *Semnopithecus*, named *S. roxellana* by the